FIG. 1A

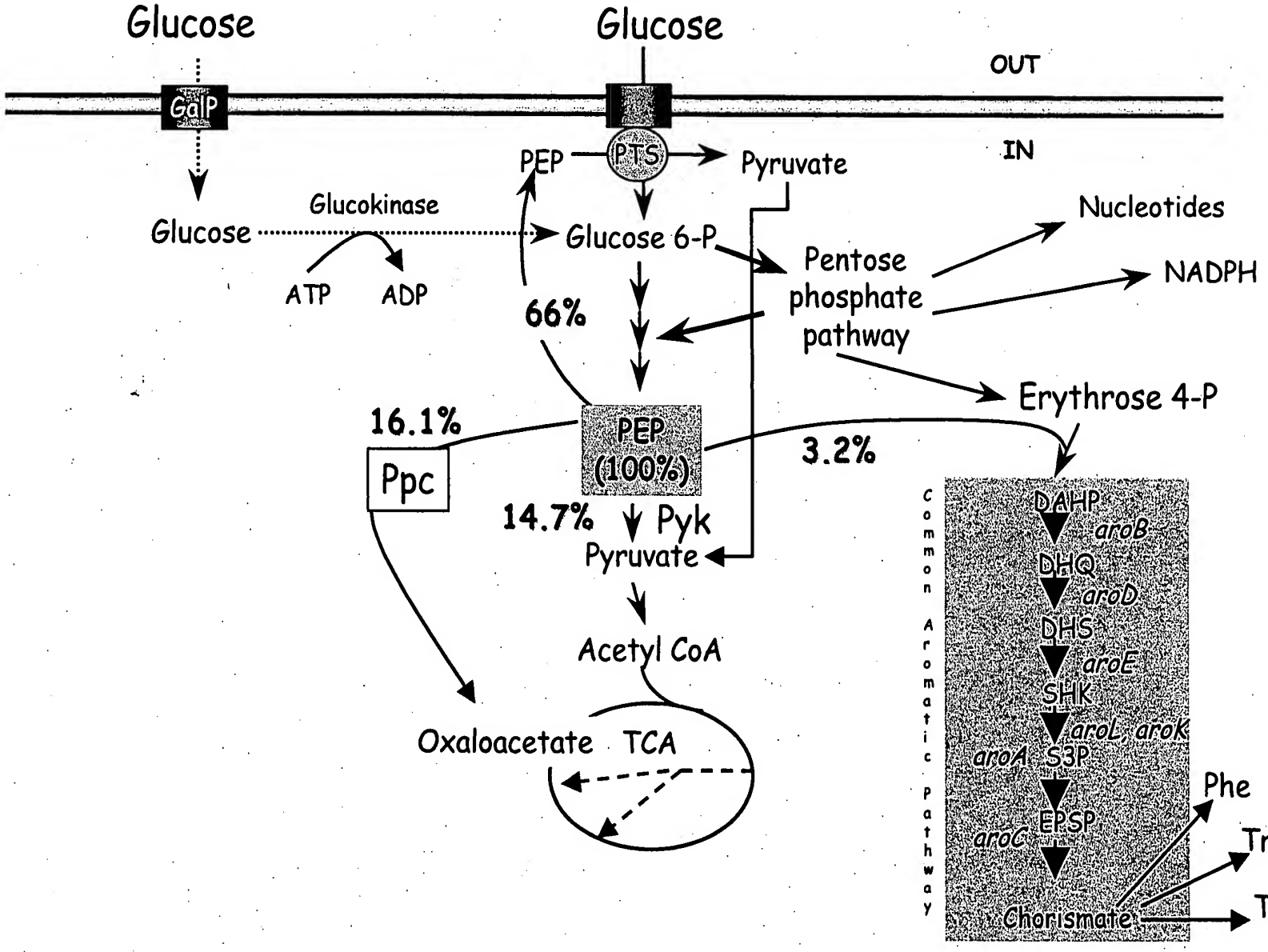
Glucose
Glucose
OUT
GalP
IN
PEP
PTS
Pyruvate
Glucokinase
Glucose
Glucose 6-P
Nucleotides
NADPH
Pentose
phosphate
pathway
ATP
ADP
66%
Erythrose 4-P
16.1%
PEP
(100%)
3.2%
Ppc
14.7%
Pyk
Pyruvate
Acetyl CoA
Oxaloacetate
TCA
DAHP
aroB
DHQ
aroD
DHS
aroE
SHK
aroL aroK
aroA S3P
EPSP
aroC
Chorismate
Phe
Trp
Tyr
Common Aromatic Pathway

FIG. 1B

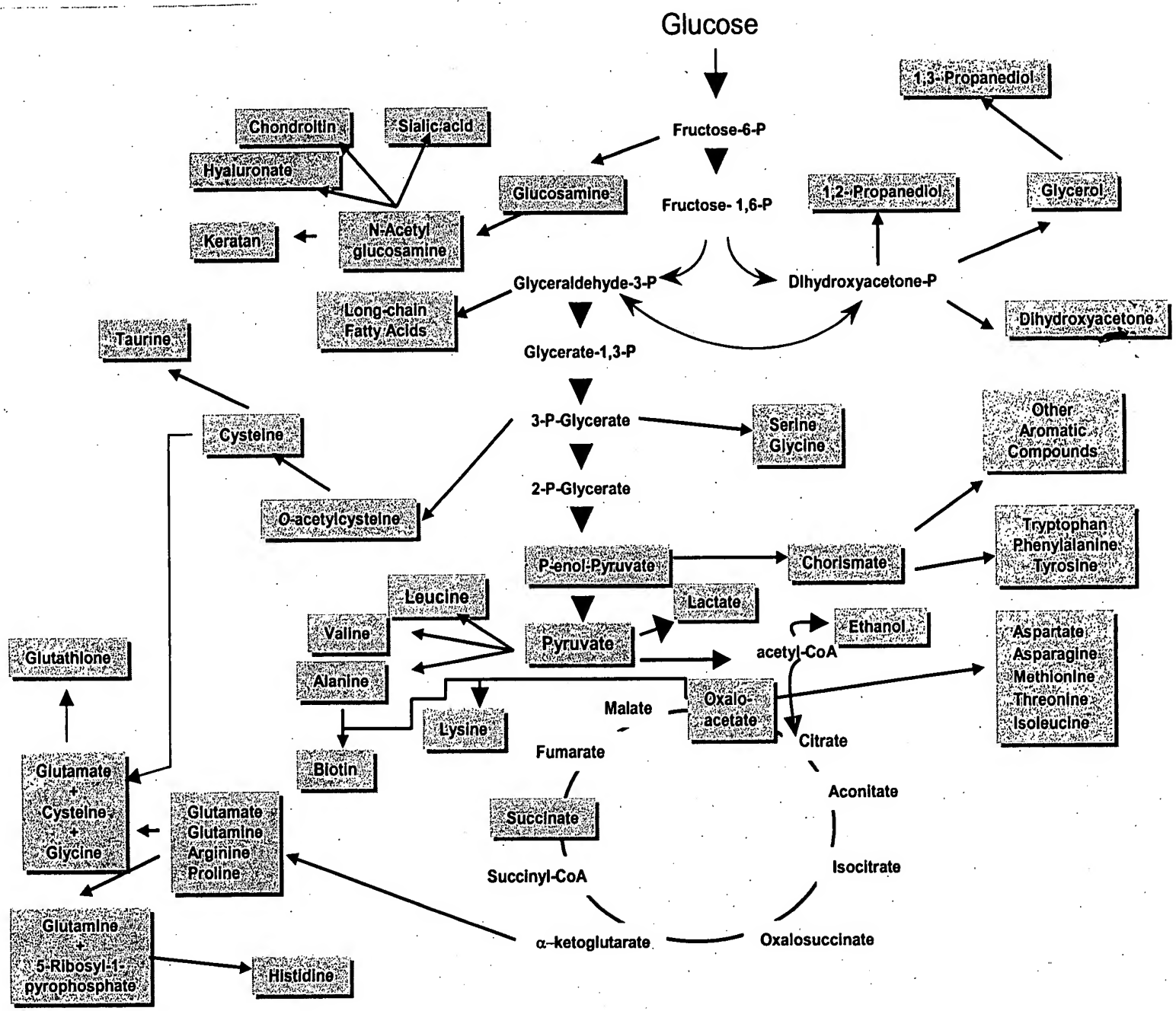
Glucose
1,3-Propanediol
Chondroitin
Sialic acid
Fructose-6-P
Hyaluronate
Glucosamine
Fructose- 1,6-P
1,2-Propanediol
Glycerol
Keratan
N-Acetyl glucosamine
Glyceraldehyde-3-P
Dihydroxyacetone-P
Long-chain Fatty Acids
Dihydroxyacetone
Taurine
Glycerate-1,3-P
Other Aromatic Compounds
Cysteine
3-P-Glycerate
Serine Glycine
2-P-Glycerate
O-acetylcysteine
Tryptophan Phenylalanine Tyrosine
P-enol-Pyruvate
Chorismate
Leucine
Lactate
Valine
Pyruvate
Ethanol
Glutathione
acetyl-CoA
Aspartate Asparagine Methionine Threonine Isoleucine
Alanine
Malate
Oxalo-acetate
Lysine
Citrate
Fumarate
Biotin
Aconitate
Glutamate + Cysteine + Glycine
Glutamate Glutamine Arginine Proline
Succinate
Isocitrate
Succinyl-CoA
Glutamine + 5-Ribosyl-1-pyrophosphate
α-ketoglutarate
Oxalosuccinate
Histidine

FIG. 2

TCGGTTTTCACAGTTGTTACATTTCTTTTCAGTAAAGTCTGGATGCATATGGC
GGCCGC*ATAACTTCGTATAGCATACATTATACGAAGTTATCTA*GAGTTGCATGC
CTGCAGGTCCGAATTTCTGCCATTCATCCGCTTATTATCACTTATTCAGGCGT
AGCACCAGGCGTTTAAGGGCACCAATAACTGCCTTAAAAAAAA**TTACGCCCC**
GCCCTGCCACTCATCGCAGTACTGTTGTAATTCATTAAGCATTCTGCCGA
CATGGAAGCCATCACAAACGGCATGATGAACCTGAATCGCCAGCGGCAT
CAGCACCTTGTCGCCTTGCGTATAATATTTGCCCATGGTGAAAACGGGG
GCGAAGAAGTTGTCCATATTGGCCACGTTTAAATCAAAACTGGTGAAAC
TCACCCAGGGATTGGCTGAGACGAAAAACATATTCTCAATAAACCCTTTA
GGGAAATAGGCCAGGTTTTCACCGTAACACGCCACATCTTGCGAATATA
TGTGTAGAAACTGCCGGAAATCGTCGTGGTATTCACTCCAGAGCGATGA
AAACGTTTCAGTTTGCTCATGGAAAACGGTGTAACAAGGGTGAACACTA
TCCCATATCACCAGCTCACCGTCTTTCATTGCCATACGGAATTCCGGATG
AGCATTCATCAGGCGGGCAAGAATGTGAATAAAGGCCGGATAAAACTTG
TGCTTATTTTTCTTTACGGTCTTTAAAAAGGCCGTAATATCCAGCTGAAC
GGTCTGGTTATAGGTACATTGAGCAACTGACTGAAATGCCTCAAAATGTT
CTTTACGATGCCATTGGGATATATCAACGGTGGTATATCCAGTGATTTTT
TTCTCCATTTTAGCTTCCTTAGCTCCTGAAAATCTCGATAACTCAAAAAATAC
GCCCGGTAGTGATCTTATTTCATTATGGTGAAAGTTGGAACCTCTTACGTGCC
GATCAACGTCTCATTTTCGCCAAAAGTTGGCCCAGGGCTTCCCGGTATCAACA
GGGACACCAGGATTTATTTATTCTGCGAAGTGATCTTCCGTCACAGGTATTTA
TTCGGACTC*TAGATAACTTCGTATAGCATACATTATACGAAGTTAT*GGATCATG
GCTGTGCAGGTCGTAAATCACTGCATAATTCGTGTCGCTCAAGGCGCACTCCC
GTTCTGGATAATGTTTTTTGCGCCGACATCATAACGGTTCTGGCAAATATTCT
GAAATGAGCTGTTGACAATTAATCATCCGGCTCGTATAATGTGTGG*AATTGTG*
*AGCGGATAACAATTT*CACACAGGAAACAGACTAATTCACAATAAAAAATAACC
ATATTGGAGGGCATCATG

FIG. 3

CAGCAGTGGTGGTGATCGGTTTTGGCTGGGGCCCCTCCCCGCACCGGAG
GCCGATTACAGCCAACCACAACAGGCAAAGGGTTTGGAAGATATTCATA
TTATTATTGCGGTTGTCACAGTTGTTACATTTCTTTTCAGTAAAGTCTGG
ATG*CATATGGCGGCCGCATAACTTCGTATAGCATACATTATACGAAGTTATGGATC*
ATGGCTGTGCAGGTCGTAAATCACTGCATAATTGGTGTCGCTCAAGGCGCACT
CCCGTTCTGGATAATGTTTTTTGCGCCGACATCATAACGGTTCTGGCAAATATT
CTGAAATGAGCTG*TTGACA*ATTAATCATCCGGCTCG*TATAAT*GTGTGGCATTG

FIG. 4

ACTTAGTTTGCCCAGCTTGCAAAAAGGCATCGCTGCAATTGGATGCATATGG
CGGCCGC*ATAACTTCGTATAGCATACATTATACGAAGTTATCTA*GAGTTGCATG
CCTGCAGGTCCGAATTTCTGCCATTCATCCGCTTATTATCACTTATTCAGGCGT
AGCACCAGGCGTTTAAGGGCACCAATAACTGCCTTAAAAAAAA**TTACGCCCC**
GCCCTGCCACTCATCGCAGTACTGTTGTAATTCATTAAGCATTCTGCCGA
CATGGAAGCCATCACAAACGGCATGATGAACCTGAATCGCCAGCGGCAT
CAGCACCTTGTCGCCTTGCGTATAATATTTGCCCATGGTGAAAACGGGG
GCGAAGAAGTTGTCCATATTGGCCACGTTTAAATCAAAACTGGTGAAAC
TCACCCAGGGATTGGCTGAGACGAAAAACATATTCTCAATAAACCCTTTA
GGGAAATAGGCCAGGTTTTCACCGTAACACGCCACATCTTGCGAATATA
TGTGTAGAAACTGCCGGAAATCGTCGTGGTATTCACTCCAGAGCGATGA
AAACGTTTCAGTTTGCTCATGGAAAACGGTGTAACAAGGGTGAACACTA
TCCCATATCACCAGCTCACCGTCTTTCATTGCCATACGGAATTCCGGATG
AGCATTCATCAGGCGGGCAAGAATGTGAATAAAGGCCGGATAAAACTTG
TGCTTATTTTTCTTTACGGTCTTTAAAAAGGCCGTAATATCCAGCTGAAC
GGTCTGGTTATAGGTACATTGAGCAACTGACTGAAATGCCTCAAAATGTT
CTTTACGATGCCATTGGGATATATCAACGGTGGTATATCCAGTGATTTTT
TTCTCCATTTTAGCTTCCTTAGCTCCTGAAAATCTCGATAACTCAAAAAATAC
GCCCGGTAGTGATCTTATTTCATTATGGTGAAAGTTGGAACCTCTTACGTGCC
GATCAACGTCTCATTTTCGCCAAAAGTTGGCCCAGGGCTTCCCGGTATCAACA
GGGACACCAGGATTTATTTATTCTGCGAAGTGATCTTCCGTCACAGGTATTTA
TTCGGACTC*TAGATAACTTCGTATAGCATACATTATACGAAGTTAT*GGATCATG
GCTGTGCAGGTCGTAAATCACTGCATAATTCGTGTCGCTCAAGGCGCACTCCC
GTTCTGGATAATGTTTTTTGCGCCGACATCATAACGGTTCTGGCAAATATTCT
GAAATGAGCTGCTGACAATTAATCATCCGGCTCGTATAATGTGTGG*AATTGTG*
*AGCGGATAACAATTT*CACACAGGAAACAGACGAGAAAGAATTATTTTGACTTT
AGCGGAGCAGTTGAAGA**ATG**

FIG. 5

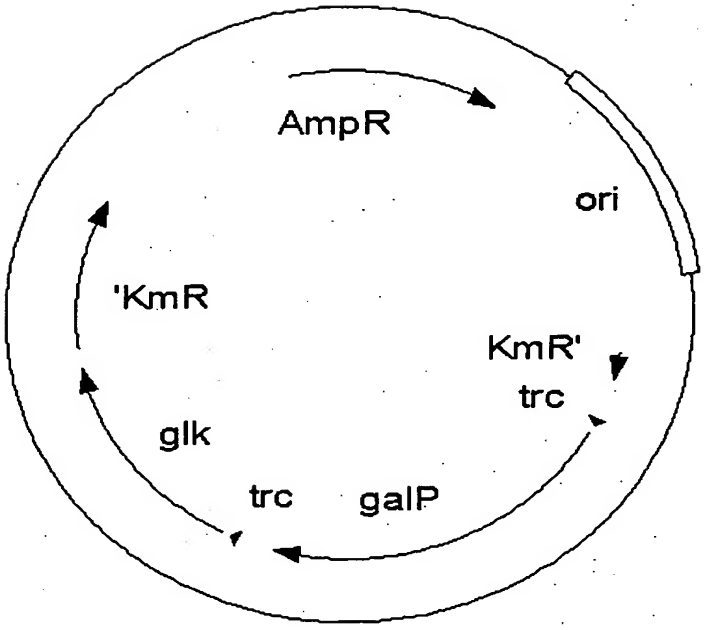

FIG. 6

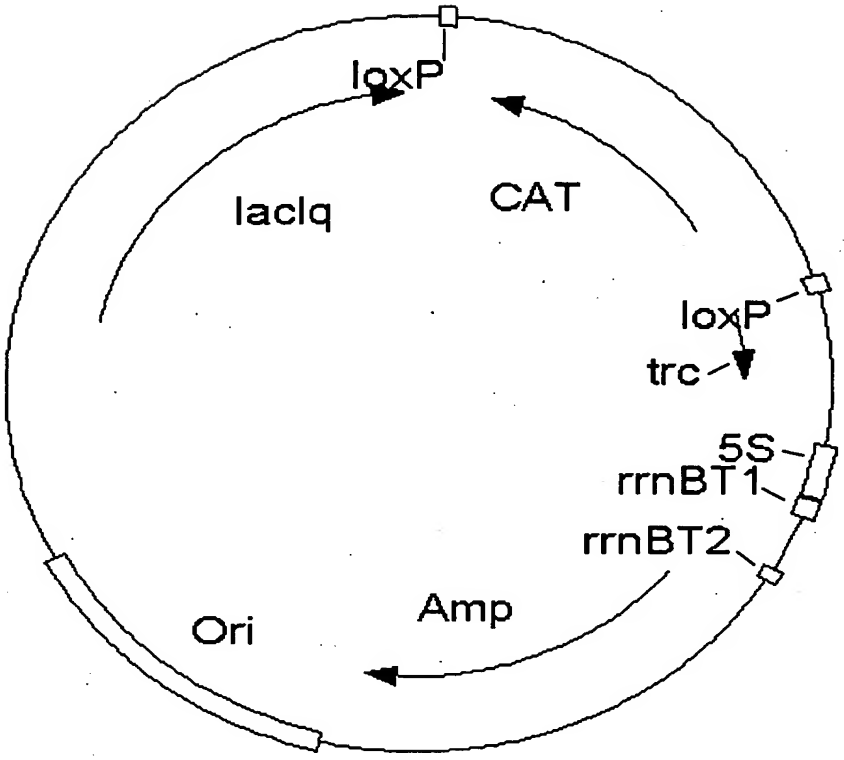

FIG. 7A.

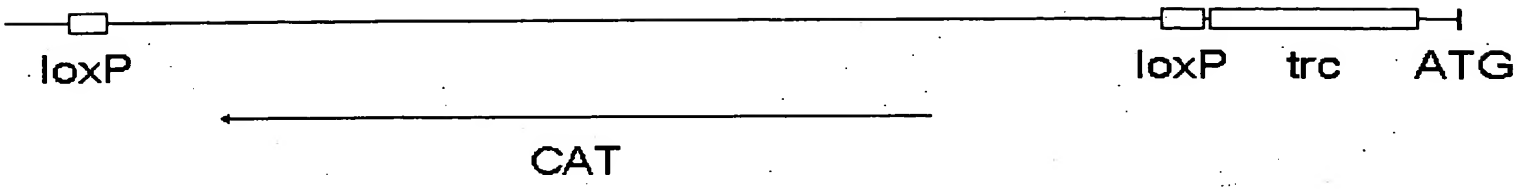

FIG. 7B

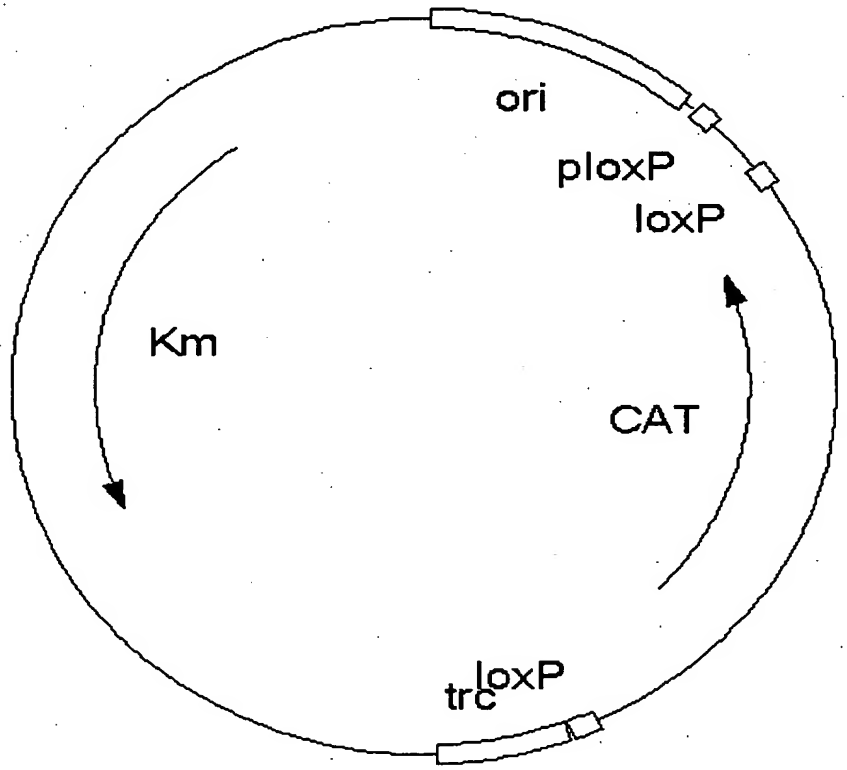

FIG. 8.

TAGTAAAGCCCTCGCTAGATTTTAATGCGGATGTTGCGATTACTTCGCCAACTATTG
CGATAACAAGAAAAAGCCAGCCTTTCATGATATATCTCCCAATTTGTGTAGGGCTTA
TTATGCACGCTTAAAAATAATAAAAGCAGACTTGACCTGATAGTTTGGCTGTGAGCA
ATTATGTGCTTAGTGCATCTAACGCTTGAGTTAAGCCGCGCCGCGAAGCGGCGTCG
GCTTGAACGAATTGTTAGACATTATTTGCCGACTACCTTGGTGATCTCGCCTTTCAC
GTAGTGGACAAATTCTTCCAACTGATCTGCGCGCGAGGCCAAGCGATCTTCTTCTT
GTCCAAGATAAGCCTGTCTAGCTTCAAGTATGACGGGCTGATACTGGGCCGGCAG
GCGCTCCATTGCCCAGTCGGCAGCGACATCCTTCGGCGCGATTTTGCCGGTTACT
GCGCTGTACCAAATGCGGGACAACGTAAGCACTACATTTCGCTCATCGCCAGCCCA
GTCGGGCGGCGAGTTCCATAGCGTTAAGGTTTCATTTAGCGCCTCAAATAGATCCT
GTTCAGGAACCGGATCAAAGAGTTCCTCCGCCGCTGGACCTACCAAGGCAACGCT
ATGTTCTCTTGCTTTTGTCAGCAAGATAGCCAGATCAATGTCGATCGTGGCTGGCTC
GAAGATACCTGCAAGAATGTCATTGCGCTGCCATTCTCCAAATTGCAGTTCGCGCT
TAGCTGGATAACGCCACGGAATGATGTCGTCGTGCACAACAATGGTGACTTCTACA
GCGCGGAGAATCTCGCTCTCTCCAGGGGAAGCCGAAGTTTCCAAAAGGTCGTTGA
TCAAAGCTCGCCGCGTTGTTTCATCAAGCCTTACGGTCACCGTAACCAGCAAATCA
ATATCACTGTGTGGCTTCAGGCCGCCATCCACTGCGGAGCCGTACAAATGTACGG
CCAGCAACGTCGGTTCGAGATGGCGCTCGATGACGCCAACTACCTCTGATAGTTGA
GTCGATACTTCGGCGATCACCGCTTCCCTCATGATGTTTAACTTTGTTTTAGGGCGA
CTGCCCTGCTGCGTAACATCGTTGCTGCTCCATAACATCAAACATCGACCCACGGC
GTAACGCGCTTGCTGCTTGGATGCCCGAGGCATAGACTGTACCCCAAAAAAACAGT
CATAACAAGCCATGAAAACCGCCACTGCGCCGTTACCACCGCTGCGTTCGGTCAA
GGTTCTGGACCAGTTGCGTGAGCGCATACGCTACTTGCATTACAGCTTACGAACCG
AACAGGCTTATGTCCACTGGGTTCGTGCCTTCATCCGTTTCCACGGTGTGCGTCAC
CCGGCAACCTTGGGCAGCAGCGAAGTCGAGGCATTTCTGTCCTGGCTGGCGAACG
AGCGCAAGGTTTCGGTCTCCACGCATCGTCAGGCATTGGCGGCCTTGCTGTTCTTC
TACGGCAAGGTGCTGTGCACGGATCTGCCCTGGCTTCAGGAGATCGGAAGACCTC
GGCCGTCGCGGCGCTTGCCGGTGGTGCTGACCCCGGATGAAGTGGTTCGCATCC

TCGGTTTTCTGGAAGGCGAGCATCGTTTGTTCGCCCAGCTTCTGTATGGAACGGGC
ATGCGGATCAGTGAGGGTTTGCAACTGCGGGTCAAGGATCTGGATTTCGATCACG
GCACGATCATCGTGCGGGAGGGCAAGGGCTCCAAGGATCGGGCCTTGATGTTACC
CGAGAGCTTGGCACCCAGCCTGCGCGAGCAGGGGAATTAATTCCCACGGGTTTTG
CTGCCCGCAAACGGGCTGTTCTGGTGTTGCTAGTTTGTTATCAGAATCGCAGATCC
GGCTTCAGCCGGTTTGCCGGCTGAAAGCGCTATTTCTTCCAGAATTGCCATGATTT
TTTCCCCACGGGAGGCGTCACTGGCTCCCGTGTTGTCGGCAGCTTTGATTCGATAA
GCAGCATCGCCTGTTTCAGGCTGTCTATGTGTGACTGTTGAGCTGTAACAAGTTGT
CTCAGGTGTTCAATTTCATGTTCTAGTTGCTTTGTTTTACTGGTTTCACCTGTTCTAT
TAGGTGTTACATGCTGTTCATCTGTTACATTGTCGATCTGTTCATGGTGAACAGCTT
TGAATGCACCAAAAACTCGTAAAAGCTCTGATGTATCTATCTTTTTTACACCGTTTTC
ATCTGTGCATATGGACAGTTTTCCCTTTGATATGTAACGGTGAACAGTTGTTCTACT
TTTGTTTGTTAGTCTTGATGCTTCACTGATAGATACAAGAGCCATAAGAACCTCAGA
TCCTTCCGTATTTAGCCAGTATGTTCTCTAGTGTGGTTCGTTGTTTTTGCGTGAGCC
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CAAAACTGGTGAGCTGAATTTTTGCAGTTAAAGCATCGTGTAGTGTTTTTCTTAGTC
CGTTATGTAGGTAGGAATCTGATGTAATGGTTGTTGGTATTTTGTCACCATTCATTTT
TATCTGGTTGTTCTCAAGTTCGGTTACGAGATCCATTTGTCTATCTAGTTCAACTTG
GAAAATCAACGTATCAGTCGGGCGGCCTCGCTTATCAACCACCAATTTCATATTGCT
GTAAGTGTTTAAATCTTTACTTATTGGTTTCAAAACCCATTGGTTAAGCCTTTTAAAC
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TAACTGGAAAAGATAAGGCAATATCTCTTCACTAAAAACTAATTCTAATTTTTCGCTT
GAGAACTTGGCATAGTTTGTCCACTGGAAAATCTCAAAGCCTTTAACCAAAGGATTC
CTGATTTCCACAGTTCTCGTCATCAGCTCTCTGGTTGCTTTAGCTAATACACCATAA
GCATTTTCCCTACTGATGTTCATCATCTGAGCGTATTGGTTATAAGTGAACGATACC
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GCTTTGAAAACAACTAATTCAGACATACATCTCAATTGGTCTAGGTGATTTTAATCAC
TATACCAATTGAGATGGGCTAGTCAATGATAATTACTAGTCCTTTTCCTTTGAGTTGT
GGGTATCTGTAAATTCTGCTAGACCTTTGCTGGAAAACTTGTAAATTCTGCTAGACC
CTCTGTAAATTCCGCTAGACCTTTGTGTGTTTTTTTTGTTTATATTCAAGTGGTTATA
ATTTATAGAATAAAGAAAGAATAAAAAAAGATAAAAAGAATAGATCCCAGCCCTGTG

TATAACTCACTACTTTAGTCAGTTCCGCAGTATTACAAAAGGATGTCGCAAACGCTG
TTTGCTCCTCTACAAAACAGACCTTAAAACCCTAAAGGCTTAAGTAGCACCCTCGCA
AGCTCGGGCAAATCGCTGAATATTCCTTTTGTCTCCGACCATCAGGCACCTGAGTC
GCTGTCTTTTTCGTGACATTCAGTTCGCTGCGCTCACGGCTCTGGCAGTGAATGGG
GGTAAATGGCACTACAGGCGCCTTTTATGGATTCATGCAAGGAAACTACCCATAATA
CAAGAAAAGCCCGTCACGGGCTTCTCAGGGCGTTTTATGGCGGGTCTGCTATGTG
GTGCTATCTGACTTTTTGCTGTTCAGCAGTTCCTGCCCTCTGATTTTCCAGTCTGAC
CACTTCGGATTATCCCGTGACAGGTCATTCAGACTGGCTAATGCACCCAGTAAGGC
AGCGGTATCATCAACAGGCTTACCCGTCTTACTGTCGGGAATTCATTTAAATAGTCA
AAAGCCTCCGACCGGAGGCTTTTGACTGCTAGGCGATCTGTGCTGTTTGCCACGGT
ATGCAGCACCAGCGCGAGATTATGGGCTCGCACGCTCGACTGTCGGACGGGGGC
ACTGGAACGAGAAGTCAGGCGAGCCGTCACGCCCTTGACAATGCCACATCCTGAG
CAAATAATTCAACCACTAAACAAATCAACCGCGTTTCCCGGAGGTAACCAAGCTTGC
GGGAGAGAATGATGAACAAGAGCCAACAAGTTCAGACAATCACCCTGGCCGCCGC
CCAGCAAATGGCGGCGGCGGTGGAAAAAAAAGCCACTGAGATCAACGTGGCGGTG
GTGTTTTCCGTAGTTGACCGCGGAGGCAACACGCTGCTTATCCAGCGGATGGACG
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CTGAAGCAAGGTACCCATGAAATTACGTCAGCGGTCCAGCCAGGACAATCTCTGTA
CGGTCTGCAGCTAACCAACCAACAGCGAATTATTATTTTTGGCGGCGGCCTGCCAG
TTATTTTTAATGAGCAGGTAATTGGCGCCGTCGGCGTTAGCGGCGGTACGGTCGAG
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GCGGGCACCATGCCGGCGCCATCAATGAGCTGTGCTGGGGGCTGGAGGAGCAGG
GGGTCCCCTGCCAGACCATAACCTATGACGGAGGCGGTGACGCCGCTGCGCTGG
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TATTCAGCAGACGCTGTTCGTGCTGGGGGCTGAACTGGCCAGCGATGCGCGGGG
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GCTTATCGACCGCAATATGGCCGAGAGCGGCCCGTTAAAACAGTTCGTGATCCCG
GGGAGGAATCTCGCCTCTGCCCAGCTGCACGTGGCGCGCACCCAGTCCCGTCGG
CTCGAACGCCTGCTGACGGCCATGGACCGCGCGCATCCGCTGCGCGACGCGCTC
AAACGCTACAGCAATCGCCTGTCGGATGCCCTGTTCTCCATGGCGCGAATCGAAGA
GACTAGGCCTGATGCTTGCGCTTGAACTGGCCTAGCAAACACAGAAAAAAGCCCG
CACCTGACAGTGCGGGCTTTTTTTTTCCTAGGCGATCTGTGCTGTTTGCCACGGTA
TGCAGCACCAGCGCGAGATTATGGGCTCGCACGCTCGACTGTCGGACGGGGGCA
CTGGAACGAGAAGTCAGGCGAGCCGTCACGCCCTTGACAATGCCACATCCTGAGC
AAATAATTCAACCACTAAACAAATCAACCGCGTTTCCCGGAGGTAACCAAGCTTCAC
CTTTTGAGCCGATGAACAATGAAAAGATCAAAACGATTTGCAGTACTGGCCCAGCG
CCCCGTCAATCAGGACGGGCTGATTGGCGAGTGGCCTGAAGAGGGGCTGATCGC
CATGGACAGCCCCTTTGACCCGGTCTCTTCAGTAAAAGTGGACAACGGTCTGATCG
TCGAACTGGACGGCAAACGCCGGGACCAGTTTGACATGATCGACCGATTTATCGC
CGATTACGCGATCAACGTTGAGCGCACAGAGCAGGCAATGCGCCTGGAGGCGGTG
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CACTACCGCCATCACGCCGGCCAAAGCGGTCGAGGTGATGGCGCAGATGAACGTG
GTGGAGATGATGATGGCGCTGCAGAAGATGCGTGCCCGCCGGACCCCCTCCAACC
AGTGCCACGTCACCAATCTCAAAGATAATCCGGTGCAGATTGCCGCTGACGCCGC
CGAGGCCGGGATCCGCGGCTTCTCAGAACAGGAGACCACGGTCGGTATCGCGCG
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GGCGTGTTGACGCAGTGCTCGGTGGAAGAGGCCACCGAGCTGGAGCTGGGCATG
CGTGGCTTAACCAGCTACGCCGAGACGGTGTCGGTCTACGGCACCGAAGCGGTAT
TTACCGACGGCGATGATACGCCGTGGTCAAAGGCGTTCCTCGCCTCGGCCTACGC
CTCCCGCGGGTTGAAAATGCGCTACACCTCCGGCACCGGATCCGAAGCGCTGATG
GGCTATTCGGAGAGCAAGTCGATGCTCTACCTCGAATCGCGCTGCATCTTCATTAC
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ATATTCGCCGCACCGCGCGCACCCTGATGCAGATGCTGCCGGGCACCGACTTTAT
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TTCGATGCGGAAGATTTTGATGATTACAACATCCTGCAGCGTGACCTGATGGTTGA
CGGCGGCCTGCGTCCGGTGACCGAGGCGGAAACCATTGCCATTCGCCAGAAAGC
GGCGCGGGCGATCCAGGCGGTTTTCCGCGAGCTGGGGCTGCCGCCAATCGCCGA
CGAGGAGGTGGAGGCCGCCACCTACGCGCACGGCAGCAACGAGATGCCGCCGCG

TAACGTGGTGGAGGATCTGAGTGCGGTGGAAGAGATGATGAAGCGCAACATCACC
GGCCTCGATATTGTCGGCGCGCTGAGCCGCAGCGGCTTTGAGGATATCGCCAGCA
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CAGACAACCCAAATTCAGCCCTCTTTTACCCTGAAAACCCGCGAGGGCGGGGTAG
CTTCTGCCGATGAACGCGCCGATGAAGTGGTGATCGGCGTCGGCCCTGCCTTCGA
TAAACACCAGCATCACACTCTGATCGATATGCCCCATGGCGCGATCCTCAAAGAGC
TGATTGCCGGGGTGGAAGAAGAGGGGCTTCACGCCCGGGTGGTGCGCATTCTGC
GCACGTCCGACGTCTCCTTTATGGCCTGGGATGCGGCCAACCTGAGCGGCTCGGG
GATCGGCATCGGTATCCAGTCGAAGGGGACCACGGTCATCCATCAGCGCGATCTG
CTGCCGCTCAGCAACCTGGAGCTGTTCTCCCAGGCGCCGCTGCTGACGCTGGAGA
CCTACCGGCAGATTGGCAAAAACGCTGCGCGCTATGCGCGCAAAGAGTCACCTTC
GCCGGTGCCGGTGGTGAACGATCAGATGGTGCGGCCGAAATTTATGGCCAAAGCC
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CCTGCACATCGACTTAGTAAGGGAGTGACCATGAGCGAGAAAACCATGCGCGTGC
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GGCAACGCCACCACCGAGGTGGCGCTGGCGTCCGACTACCCGCAGGCGAGGGCG
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TGAGCGATGTCTCTCGCATCTATCTTAACGAAGCCGCGCCGGTGATTGGCGATGTG
GCGATGGAGACCATCACCGAGACCATTATCACCGAATCGACCATGATCGGTCATAA
CCCGCAGACGCCGGGCGGGGTGGGCGTTGGCGTGGGGACGACTATCGCCCTCG
GGCGGCTGGCGACGCTGCCGGCGGCGCAGTATGCCGAGGGGTGGATCGTACTGA
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GAACAACCGCCTGCGTAAAACCCTGCCGGTGGTGGATGAAGTGACGCTGCTGGAG
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AGCCTGTTGATTAAAACCGAGCTGGGCCTCGAGGATCTTTCGCTGGCGGAAGCGA
TAAAAAAATACCCGCTGGCCAAAGTGGAAAGCCTGTTCAGTATTCGTCACGAGAAT
GGCGCGGTGGAGTTCTTTCGGGAAGCCCTCAGCCCGGCGGTGTTCGCCAAAGTG
GTGTACATCAAGGAGGGCGAACTGGTGCCGATCGATAACGCCAGCCCGCTGGAAA
AAATTCGTCTCGTGCGCCGGCAGGCGAAAGAGAAAGTGTTTGTCACCAACTGCCTG
CGCGCGCTGCGCCAGGTCTCACCCGGCGGTTCCATTCGCGATATCGCCTTTGTGG
TGCTGGTGGGCGGCTCATCGCTGGACTTTGAGATCCCGCAGCTTATCACGGAAGC
CTTGTCGCACTATGGCGTGGTCGCCGGGCAGGGCAATATTCGGGGAACAGAAGGG
CCGCGCAATGCGGTCGCCACCGGGCTGCTACTGGCCGGTCAGGCGAATTAAACG
GGCGCTCGCGCCAGCCTCTAGGTACAAATAAAAAAGGCACGTCAGATGACGTGCC
TTTTTTCTTGTCTAGAGTACTGGCGAAAGGGGGATGTGCTGCAAGGCGATTAAGTT
GGGTAACGCCAGGGTTTTCCCAGTCACGACGTTGTAAAACGACGGCCAGTGAATTC
GAGCTCGGTACCCGGGGCGGCCGCGCTAGCGCCCGATCCAGCTGGAGTTTGTAG
AAACGCAAAAAGGCCATCCGTCAGGATGGCCTTCTGCTTAATTTGATGCCTGGCAG
TTTATGGCGGGCGTCCTGCCCGCCACCCTCCGGGCCGTTGCTTCGCAACGTTCAA
ATCCGCTCCCGGCGGATTTGTCCTACTCAGGAGAGCGTTCACCGACAAACAACAGA
TAAAACGAAAGGCCCAGTCTTTCGACTGAGCCTTTCGTTTTATTTGATGCCTGGCAG
TTCCCTACTCTCGCATGGGGAGACCCCACACTACCATCGGCGCTACGGCGTTTCAC
TTCTGAGTTCGGCATGGGGTCAGGTGGGACCACCGCGCTACTGCCGCCAGGCAAA

TTCTGTTTTATCAGACCGCTTCTGCGTTCTGATTTAATCTGTATCAGGCTGAAAATCT
TCTCTCATCCGCCAAAACAGCCAAGCTTGCATGCCTGCAGCCCGGGTTACCATTTC
AACAGATCGTCCTTAGCATATAAGTAGTCGTCAAAAATGAATTCAACTTCGTCTGTTT
CGGCATTGTAGCCGCCAACTCTGATGGATTCGTGGTTTTTGACAATGATGTCACAG
CCTTTTTCCTTTAGGAAGTCCAAGTCGAAAGTAGTGGCAATACCAATGATCTTACAA
CCGGCGGCTTTTCCGGCGGCAATACCTGCTGGAGCGTCTTCAAATACTACTACCTT
AGATTTGGAAGGGTCTTGCTCATTGATCGGATATCCTAAGCCATTCCTGCCCTTCAG
ATATGGTTCTGGATGAGGCTTACCCTGTTTGACATCATTAGCGGTAATGAAGTACTT
TGGTCTCCTGATTCCCAGATGCTCGAACCATTTTTGTGCCATATCACGGGTACCGG
AAGTTGCCACAGCCCATTTCTCTTTTGGTAGAGCGTTCAAAGCGTTGCACAGCTTAA
CTGCACCTGGGACTTCAATGGATTTTTCACCGTACTTGACCGGAATTTCAGCTTCTA
ATTTGTTAACATACTCTTCATTGGCAAAGTCTGGAGCGAACTTAGCAATGGCATCAA
ACGTTCTCCAACCATGCGAGACTTGGATAACGTGTTCAGCATCGAAATAAGGTTTGT
CCTTACCGAAATCCCTCCAGAATGCAGCAATGGCTGGTTGAGAGATGATAATGGTA
CCGTCGACGTCGAACAAAGCGGCGTTAACTTTCAAAGATAGAGGTTTAGTAGTCAA
TCCCATAATTCTAGTCTGTTTCCTGGATCCAATAAATCTAATCTTCATGTAGATCTAA
TTCTTCAATCATGTCCGGCAGGTTCTTCATTGGGTAGTTGTTGTAAACGATTTGGTA
TACGGCTTCAAATAATGGGAAGTCTTCGACAGAGCCACATGTTTCCAACCATTCGT
GAACTTCTTTGCAGGTAATTAAACCTTGAGCGGATTGGCCATTCAACAACTCCTTTT
CACATTCCCAGGCGTCCTTACCAGAAGTAGCCATTAGCCTAGCAACCTTGACGTTT
CTACCACCAGCGCAGGTGGTGATCAAATCAGCAACACCAGCAGACTCTTGGTAGTA
TGTTTCTTCTCTAGATTCTGGGAAAAACATTTGACCGAATCTGATGATCTCACCCAA
ACCGACTCTTTGGATGGCAGCAGAAGCGTTGTTACCCCAGCCTAGACCTTCGACGA
AACCACAACCTAAGGCAACAACGTTCTTCAAAGCACCACAGATGGAGATACCAGCA
ACATCTTCGATGACACTAACGTGGAAGTAAGGTCTGTGGAACAAGGCCTTTAGAAC
CTTATGGTCGACGTCCTTGCCCTCGCCTCTGAAATCCTTTGGAATGTGGTAAGCAA
CTGTTGTTTCAGACCAGTGTTCTTGAGCGACTTCGGTGGCAATGTTAGCACCAGAT
AGAGCACCACATTGAATACCTAGTTCCTCAGTGATGTAAGAGGATAGCAATTGGAC
ACCTTTAGCACCAACTTCAAAACCCTTTAGACAGGAGATAGCTCTGACGTGTGAATC
AACATGACCTTTCAATTGGCTACAGATACGGGGCAAAAATTGATGTGGAATGTTGAA
AACGATGATGTCGACATCCTTGACTGAATCAATCAAGTCTGGATTAGCAACCAAATT
GTCGGGTAGAGTGATGCCAGGCAAGTATTTCACGTTTTGATGTCTAGTATTTATGAT
TTCAGTCAATTTTTCACCATTGATCTCTTCTTCGAACACCCACATTTGTACTATTGGA
GCGAAAACTTCTGGGTATCCCTTACAATTTTCGGCAACCACCTTGGCAATAGTAGTA

CCCCAGTTACCAGATCCAATCACAGTAACCTTGAAAGGCTTTTCGGCAGCCTTCAA
AGAAACAGAAGAGGAACTTCTCTTTCTACCAGCATTCAAGTGGCCGGAAGTTAAGT
TTAATCTATCAGCAGCAGCAGCCATGGAATTGTCCTCCTTACTAGTCATGGTCTGTT
TCCTGTGTGAAATTGTTATCCGCTCACAATTCCACACATTATACGAGCCGGATGATT
AATTGTCAACAGCTCATTTCAGAATATTTGCCAGAACCGTTATGATGTCGGCGCAAA
AAACATTATCCAGAACGGGAGTGCGCCTTGAGCGACACGAATTATGCAGTGATTTA
CGACCTGCACAGCCATACCACAGCTTCCGATGGCTGCCTGACGCCAGAAGCATTG
GTGCACGCTAGCCAGTACATTTAAATGGTACCCTCTAGTCAAGGCCTTAAGTGAGT
CGTATTACGGACTGGCCGTCGTTTTACAACGTCGTGACTGGGAAAACCCTGGCGTT
ACCCAACTTAATCGCCTTGCAGCACATCCCCCTTTCGCCAGCTGGCGTAATAGCGA
AGAGGCCCGCACCGATCGCCCTTCCCAACAGTTGCGCAGCCTGAATGGCGAATGG
CGCCTGATGCGGTATTTTCTCCTTACGCATCTGTGCGGTATTTCACACCGCATATG
GTGCACTCTCAGTACAATCTGCTCTGATGCCGCATAGTTAAGCCAGCCCCGACACC
CGCCAACACCCGCTGACGAGCT

FIG. 9

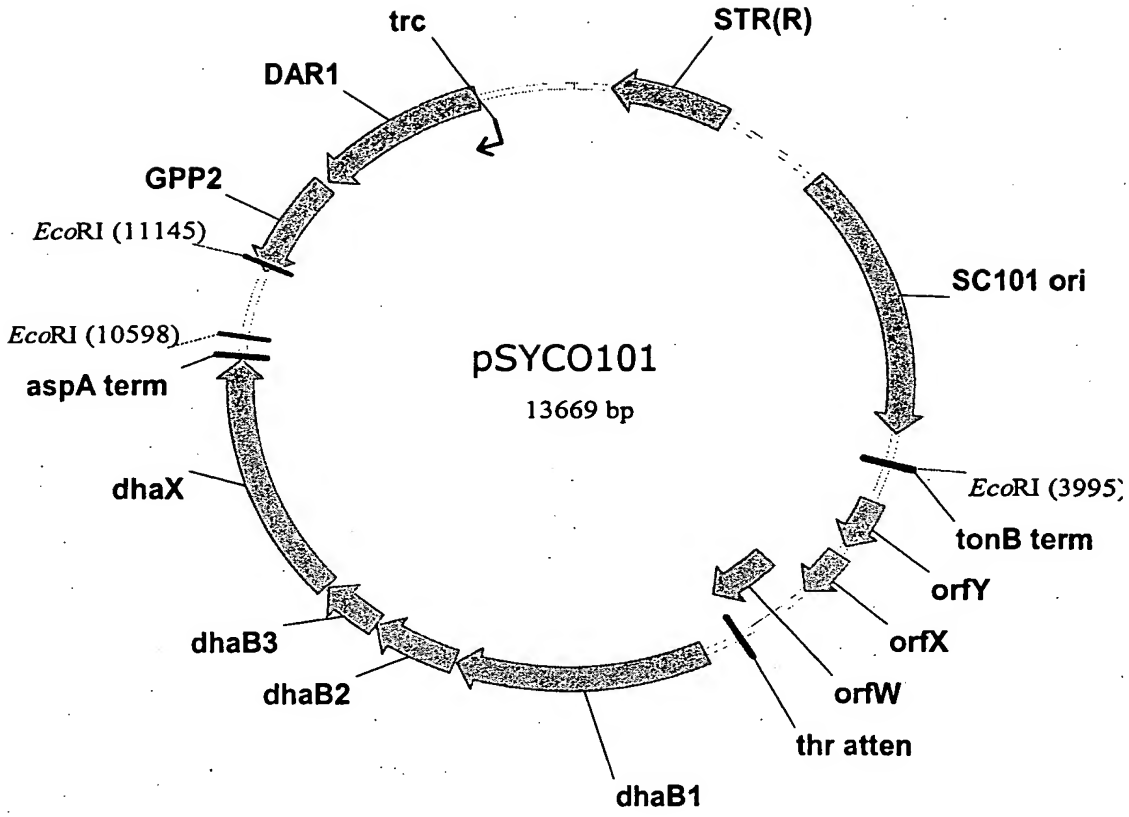
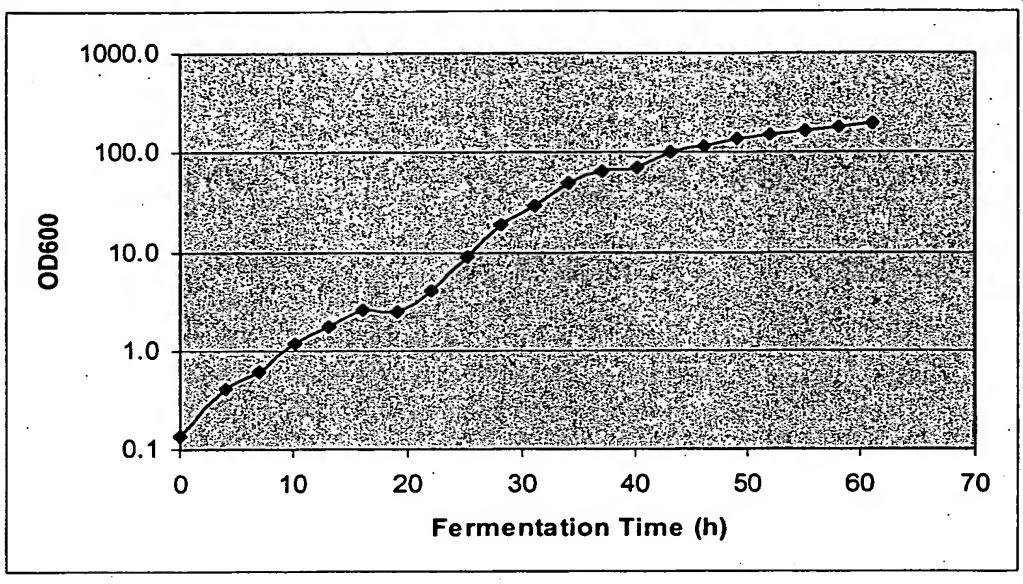

trc
STR(R)
DAR1
GPP2
EcoRI (11145)
SC101 ori
EcoRI (10598)
pSYCO101
13669 bp
aspA term
EcoRI (3995)
tonB term
dhaX
orfY
orfX
dhaB3
orfW
dhaB2
thr atten
dhaB1

FIG. 10.

A.


1000.0
100.0
10.0
1.0
0.1
OD600
0
10
20
30
40
50
60
70
Fermentation Time (h)

B.

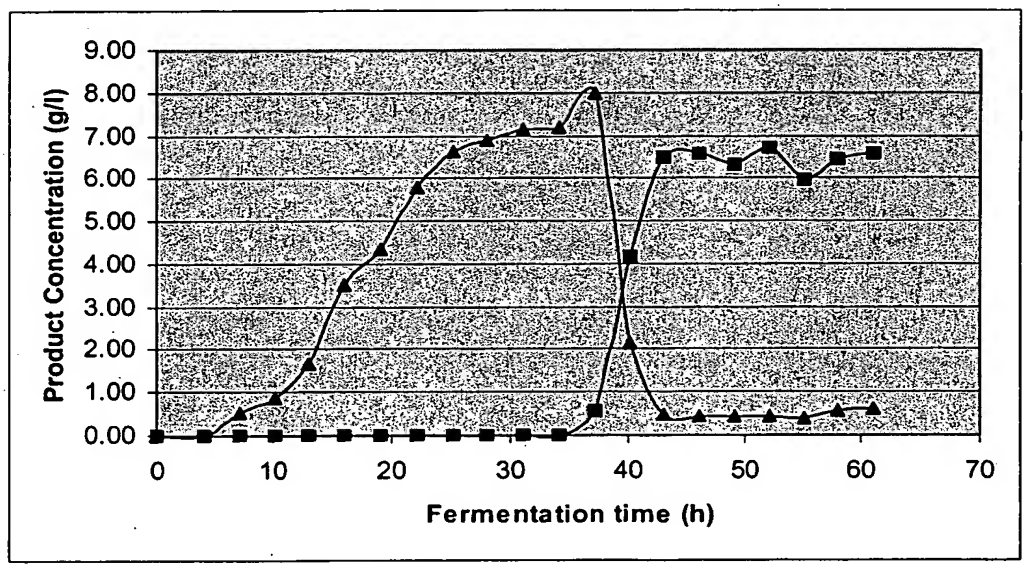
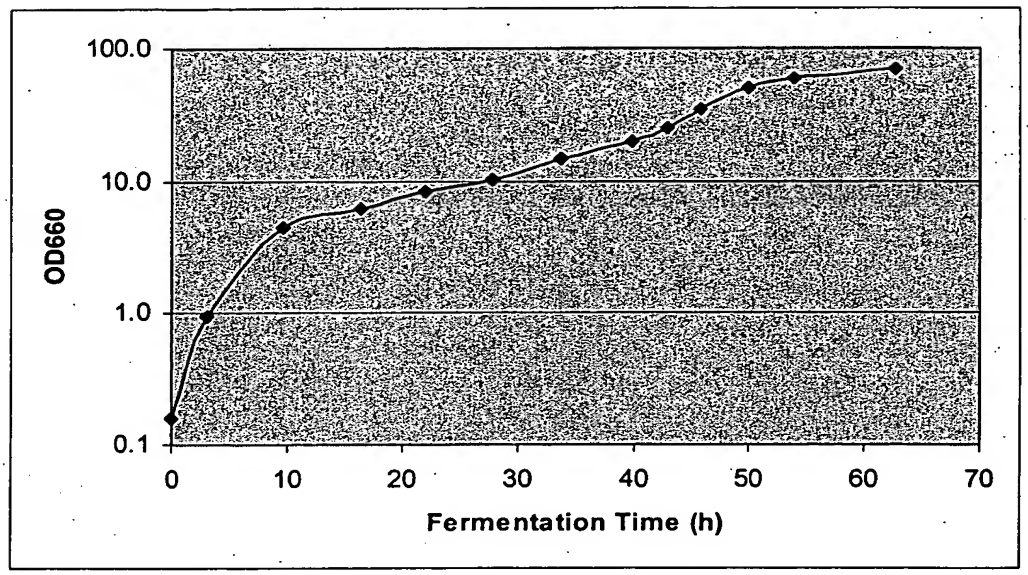

9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Product Concentration (g/l)
0
10
20
30
40
50
60
70
Fermentation time (h)

FIG. 11

A.


100.0
10.0
1.0
0.1
OD660
0
10
20
30
40
50
60
70
Fermentation Time (h)

B.

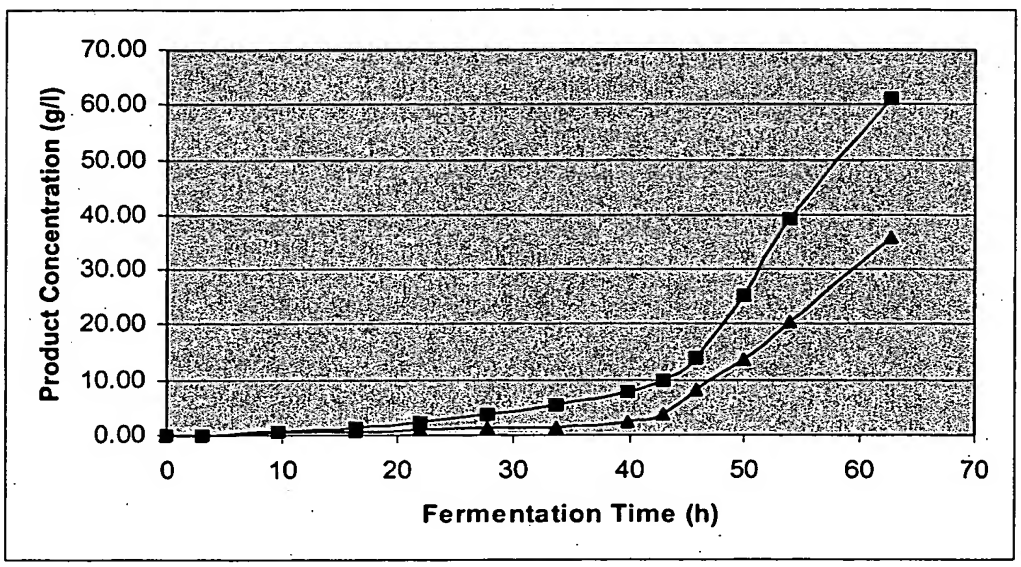
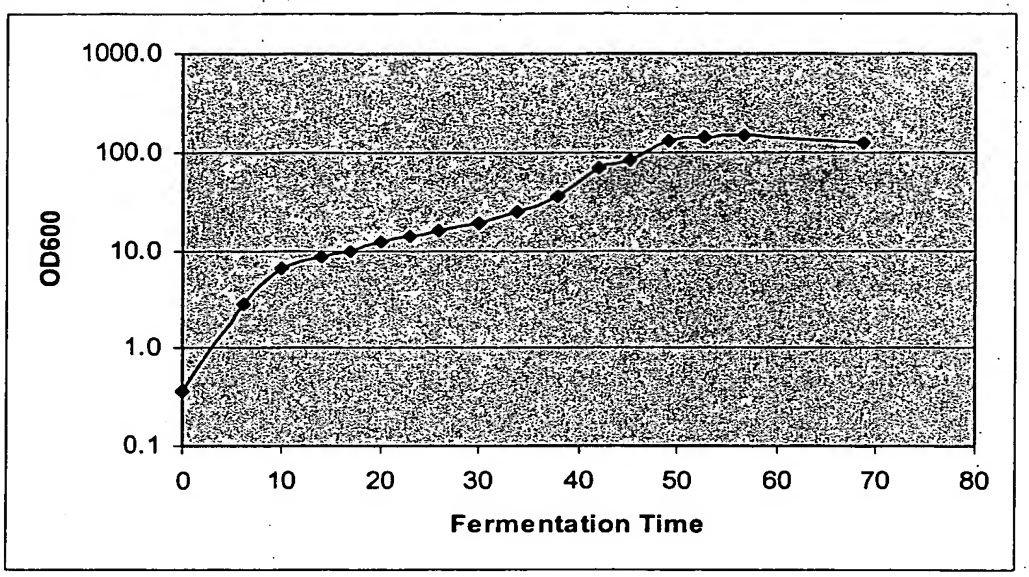
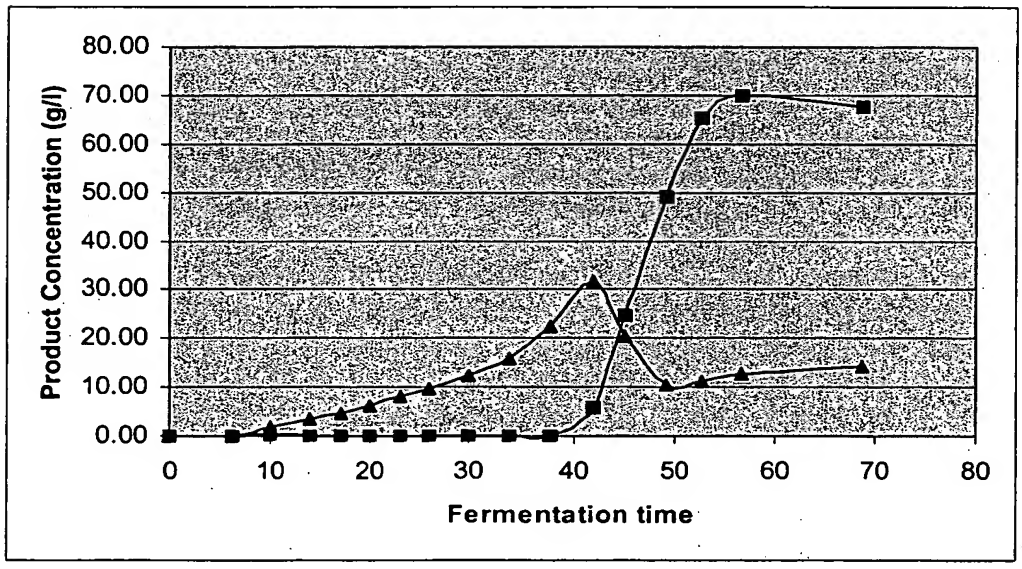

70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
Product Concentration (g/l)
0
10
20
30
40
50
60
70
Fermentation Time (h)

FIG. 12

A.


1000.0
100.0
10.0
1.0
0.1
OD600
0
10
20
30
40
50
60
70
80
Fermentation Time

B.


80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
Product Concentration (g/l)
0
10
20
30
40
50
60
70
80
Fermentation time

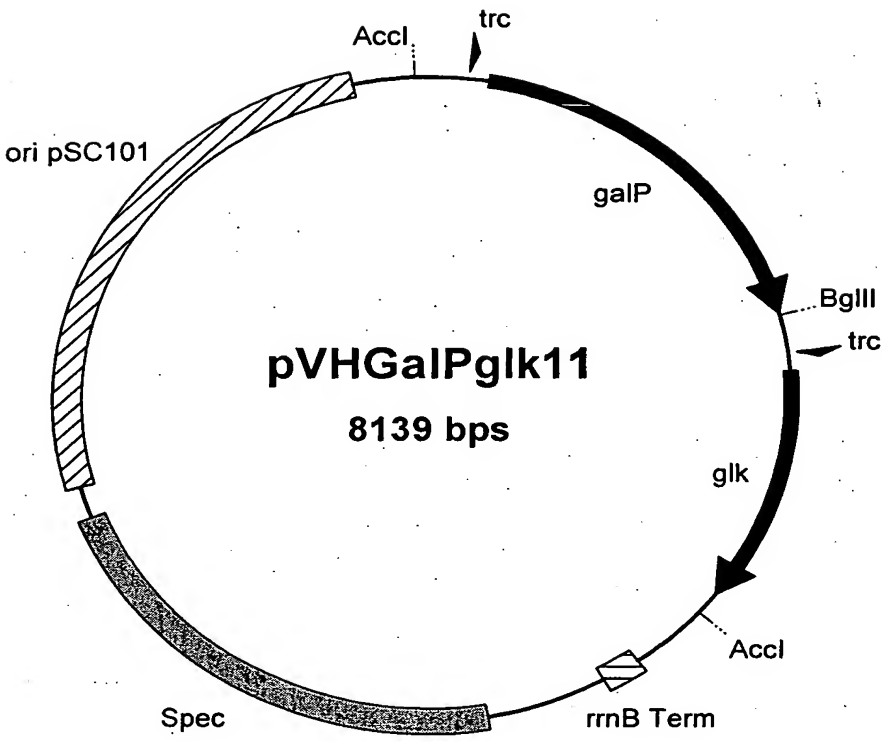

AccI
trc
ori pSC101
galP
BglII
trc
pVHGalPglk11
8139 bps
glk
AccI
Spec
rrnB Term

FIG. 13

CAGCTGAGATCTCCTAGAGCTCGCCGGCGGTCACACTACCTATAGACGTCTTAAGCGGGAACCTTCGACACCATACCGACACGTCCAGCATTTAGTGACG

ATAATTCGTGTCGCTCAAGGCGCACTCCCGTTCTGGATAATGTTTTTTGCGCCGACATCATAACGGTTCTGGCAAATATTCTGAAATGAGCTGTTGACAA 200
TATTAAGCACAGCGAGTTCCGCGTGAGGGCAAGACCTATTACAAAAAACGCGGCTGTAGTATTGCCAAGACCGTTTATAAGACTTTACTCGACAACTGTT

Trc Pro -

TTAATCATCCGGCTCGTATAATGTGTGGAATTGTGAGCGGATAACAATTTCACACAGGAAACAGACCATGCCTGACGCTAAAAAACAGGGGCGGTCAAAC 300
AATTAGTAGGCCGAGCATATTACACACCTTAACACTCGCCTATTGTTAAAGTGTGTCCTTTGTCTGGTACGGACTGCGATTTTTTGTCCCCGCCAGTTTG

Trc Promoter

Met Pro Asp Ala Lys Lys Gln Gly Arg Ser Asn
galP

AAGGCAATGACGTTTTTCGTCTGCTTCCTTGCCGCTCTGGCGGGATTACTCTTTGGCCTGGATATCGGTGTAATTGCTGGCGCACTGCCGTTTATTGCAG 400
TTCCGTTACTGCAAAAAGCAGACGAAGGAACGGCGAGACCGCCCTAATGAGAAACCGGACCTATAGCCACATTAACGACCGCGTGACGGCAAATAACGTC
Lys Ala Met Thr Phe Phe Val Cys Phe Leu Ala Ala Leu Ala Gly Leu Leu Phe Gly Leu Asp Ile Gly Val Ile Ala Gly Ala Leu Pro Phe Ile Ala
galP

ATGAATTCCAGATTACTTCGCACACGCAAGAATGGGTCGTAAGCTCCATGATGTTCGGTGCGGCAGTCGGTGCGGTGGGCAGCGGCTGGCTCTCCTTTAA 500
TACTTAAGGTCTAATGAAGCGTGTGCGTTCTTACCCAGCATTCGAGGTACTACAAGCCACGCCGTCAGCCACGCCACCCGTCGCCGACCGAGAGGAAATT
Asp Glu Phe Gln Ile Thr Ser His Thr Gln Glu Trp Val Val Ser Ser Met Met Phe Gly Ala Ala Val Gly Ala Val Gly Ser Gly Trp Leu Ser Phe Lys
galP

ACTCGGGCGCAAAAAGAGCCTGATGATCGGCGCAATTTTGTTTGTTGCCGGTTCGCTGTTCTCTGCGGCTGCGCCAAACGTTGAAGTACTGATTCTTTCC 600
TGAGCCCGCGTTTTTCTCGGACTACTAGCCGCGTTAAAACAAACAACGGCCAAGCGACAAGAGACGCCGACGCGGTTTGCAACTTCATGACTAAGAAAGG
Leu Gly Arg Lys Lys Ser Leu Met Ile Gly Ala Ile Leu Phe Val Ala Gly Ser Leu Phe Ser Ala Ala Ala Pro Asn Val Glu Val Leu Ile Leu Ser
galP

CGCGTTCTACTGGGGCTGGCGGTGGGTGTGGCCTCTTATACCGCACCGCTGTACCTCTCTGAAATTGCGCCGGAAAAAATTCGTGGCAGTATGATCTCGA 700
GCGCAAGATGACCCCGACCGCCACCCACACCGGAGAATATGGCGTGGCGACATGGAGAGACTTTAACGCGGCCTTTTTTAAGCACCGTCATACTAGAGCT
Arg Val Leu Leu Gly Leu Ala Val Gly Val Ala Ser Tyr Thr Ala Pro Leu Tyr Leu Ser Glu Ile Ala Pro Glu Lys Ile Arg Gly Ser Met Ile Ser
galP

FIG. 14A

TGTATCAGTTGATGATCACTATCGGGATCCTCGGTGCTTATCTTTCTGATACCGCCTTCAGCTACACCGGTGCATGGCGCTGGATGCTGGGTGTGATTAT 800
ACATAGTCAACTACTAGTGATAGCCCTAGGAGCCACGAATAGAAAGACTATGGCGGAAGTCGATGTGGCCACGTACCGCGACCTACGACCCACACTAATA ;

Met Tyr Gln Leu Met Ile Thr Ile Gly Ile Leu Gly Ala Tyr Leu Ser Asp Thr Ala Phe Ser Tyr Thr Gly Ala Trp Arg Trp Met Leu Gly Val Ile Ile

galP

CATCCCGGCAATTTTGCTGCTGATTGGTGTCTTCTTCCTGCCAGACAGCCCACGTTGGTTTGCCGCCAAACGCCGTTTTGTTGATGCCGAACGCGTGCTG 900
GTAGGGCCGTTAAAACGACGACTAACCACAGAAGAAGGACGGTCTGTCGGGTGCAACCAAACGGCGGTTTGCGGCAAAACAACTACGGCTTGCGCACGAC

Ile Pro Ala Ile Leu Leu Leu Ile Gly Val Phe Phe Leu Pro Asp Ser Pro Arg Trp Phe Ala Ala Lys Arg Arg Phe Val Asp Ala Glu Arg Val Leu

galP

CTACGCCTGCGTGACACCAGCGCGGAAGCGAAACGCGAACTGGATGAAATCCGTGAAAGTTTGCAGGTTAAACAGAGTGGCTGGGCGCTGTTTAAAGAGA 1000
GATGCGGACGCACTGTGGTCGCGCCTTCGCTTTGCGCTTGACCTACTTTAGGCACTTTCAAACGTCCAATTTGTCTCACCGACCCGCGACAAATTTCTCT

Leu Arg Leu Arg Asp Thr Ser Ala Glu Ala Lys Arg Glu Leu Asp Glu Ile Arg Glu Ser Leu Gln Val Lys Gln Ser Gly Trp Ala Leu Phe Lys Glu

galP

ACAGCAACTTCCGCCGCGCGGTGTTCCTTGGCGTACTGTTGCAGGTAATGCAGCAATTCACCGGGATGAACGTCATCATGTATTACGCGCCGAAAATCTT 1100
TGTCGTTGAAGGCGGCGCGCCACAAGGAACCGCATGACAACGTCCATTACGTCGTTAAGTGGCCCTACTTGCAGTAGTACATAATGCGCGGCTTTTAGAA

Asn Ser Asn Phe Arg Arg Ala Val Phe Leu Gly Val Leu Leu Gln Val Met Gln Gln Phe Thr Gly Met Asn Val Ile Met Tyr Tyr Ala Pro Lys Ile Phe

galP

CGAACTGGCGGGTTATACCAACACTACCGAGCAAATGTGGGGGACCGTGATTGTCGGCCTGACCAACGTACTTGCCACCTTTATCGCAATCGGCCTTGTT 1200
GCTTGACCGCCCAATATGGTTGTGATGGCTCGTTTACACCCCCTGGCACTAACAGCCGGACTGGTTGCATGAACGGTGGAAATAGCGTTAGCCGGAACAA

Glu Leu Ala Gly Tyr Thr Asn Thr Thr Glu Gln Met Trp Gly Thr Val Ile Val Gly Leu Thr Asn Val Leu Ala Thr Phe Ile Ala Ile Gly Leu Val

galP

GACCGCTGGGGACGTAAACCAACGCTAACGCTGGGCTTCCTGGTGATGGCTGCTGGCATGGGCGTACTCGGTACAATGATGCATATCGGTATTCACTCTC 1300
CTGGCGACCCCTGCATTTGGTTGCGATTGCGACCCGAAGGACCACTACCGACGACCGTACCCGCATGAGCCATGTTACTACGTATAGCCATAAGTGAGAG

Asp Arg Trp Gly Arg Lys Pro Thr Leu Thr Leu Gly Phe Leu Val Met Ala Ala Gly Met Gly Val Leu Gly Thr Met Met His Ile Gly Ile His Ser

galP

CGTCGGCGCAGTATTTCGCCATCGCCATGCTGCTGATGTTTATTGTCGGTTTTGCCATGAGTGCCGGTCCGCTGATTTGGGTACTGTGCTCCGAAATTCA 1400
GCAGCCGCGTCATAAAGCGGTAGCGGTACGACGACTACAAATAACAGCCAAAACGGTACTCACGGCCAGGCGACTAAACCCATGACACGAGGCTTTAAGT

Pro Ser Ala Gln Tyr Phe Ala Ile Ala Met Leu Leu Met Phe Ile Val Gly Phe Ala Met Ser Ala Gly Pro Leu Ile Trp Val Leu Cys Ser Glu Ile Gln

galP

FIG. 14B


GCCGCTGAAAGGCCGCGATTTTGGCATCACCTGCTCCACTGCCACCAACTGGATTGCCAACATGATCGTTGGCGCAACGTTCCTGACCATGCTCAACACG 1500
CGGCGACTTTCCGGCGCTAAAACCGTAGTGGACGAGGTGACGGTGGTTGACCTAACGGTTGTACTAGCAACCGCGTTGCAAGGACTGGTACGAGTTGTGC
Pro Leu Lys Gly Arg Asp Phe Gly Ile Thr Cys Ser Thr Ala Thr Asn Trp Ile Ala Asn Met Ile Val Gly Ala Thr Phe Leu Thr Met Leu Asn Thr
galP
CTGGGTAACGCCAACACCTTCTGGGTGTATGCGGCTCTGAACGTACTGTTTATCCTGCTGACATTGTGGCTGGTACCGGAAACCAAACACGTTTCGCTGG 1600
GACCCATTGCGGTTGTGGAAGACCCACATACGCCGAGACTTGCATGACAAATAGGACGACTGTAACACCGACCATGGCCTTTGGTTTGTGCAAAGCGACC
Leu Gly Asn Ala Asn Thr Phe Trp Val Tyr Ala Ala Leu Asn Val Leu Phe Ile Leu Leu Thr Leu Trp Leu Val Pro Glu Thr Lys His Val Ser Leu
galP
AACATATTGAACGTAATCTGATGAAAGGTCGTAAACTGCGCGAAATAGGCGCTCACGATTAATCTCCCCAAGCTTCCTCCCATCGCGGAGGAAACCACCT 1700
TTGTATAACTTGCATTAGACTACTTTCCAGCATTTGACGCGCTTTATCCGCGAGTGCTAATTAGAGGGGTTCGAAGGAGGGTAGCGCCTCCTTTGGTGGA
Glu His Ile Glu Arg Asn Leu Met Lys Gly Arg Lys Leu Arg Glu Ile Gly Ala His Asp
galP
CTTGCAGTCATCTTTTCTTCGCTCTATCCTCTGCCGCTAATCCATATGACTAGATCTGCAGAATTCGCCCTTAAGGAAGCTGTGGTATGGCTGTGCAGGT 1800
GAACGTCAGTAGAAAAGAAGCGAGATAGGAGACGGCGATTAGGTATACTGATCTAGACGTCTTAAGCGGGAATTCCTTCGACACCATACCGACACGTCCA
CGTAAATCACTGCATAATTCGTGTCGCTCAAGGCGCACTCCCGTTCTGGATAATGTTTTTTGCGCCGACATCATAACGGTTCTGGCAAATATTCTGAAAT 1900
GCATTTAGTGACGTATTAAGCACAGCGAGTTCCGCGTGAGGGCAAGACCTATTACAAAAAACGCGGCTGTAGTATTGCCAAGACCGTTTATAAGACTTTA
GAGCTGTTGACAATTAATCATCCGGCTCGTATAATGTGTGGAATTGTGAGCGGATAACAATTTCACACAGGAAACAGACCATGACAAAGTATGCATTAGT 2000
CTCGACAACTGTTAATTAGTAGGCCGAGCATATTACACACCTTAACACTCGCCTATTGTTAAAGTGTGTCCTTTGTCTGGTACTGTTTCATACGTAATCA
Trc promoter
Met Thr Lys Tyr Ala Leu Val
glk
CGGTGATGTGGGCGGCACCAACGCACGTCTTGCTCTGTGTGATATTGCCAGTGGTGAAATCTCGCAGGCTAAGACCTATTCAGGGCTTGATTACCCCAGC 2100
GCCACTACACCCGCCGTGGTTGCGTGCAGAACGAGACACACTATAACGGTCACCACTTTAGAGCGTCCGATTCTGGATAAGTCCCGAACTAATGGGGTCG
Gly Asp Val Gly Gly Thr Asn Ala Arg Leu Ala Leu Cys Asp Ile Ala Ser Gly Glu Ile Ser Gln Ala Lys Thr Tyr Ser Gly Leu Asp Tyr Pro Ser
glk
CTCGAAGCGGTCATTCGCGTTTATCTTGAAGAACATAAGGTCGAGGTGAAAGACGGCTGTATTGCCATCGCTTGCCCAATTACCGGTGACTGGGTGGCGA 2200
GAGCTTCGCCAGTAAGCGCAAATAGAACTTCTTGTATTCCAGCTCCACTTTCTGCCGACATAACGGTAGCGAACGGGTTAATGGCCACTGACCCACCGCT
Leu Glu Ala Val Ile Arg Val Tyr Leu Glu Glu His Lys Val Glu Val Lys Asp Gly Cys Ile Ala Ile Ala Cys Pro Ile Thr Gly Asp Trp Val Ala
glk

FIG. 14C

TGACCAACCATACCTGGGCGTTCTCAATTGCCGAAATGAAAAAGAATCTCGGTTTTAGCCATCTGGAAATTATTAACGATTTTACCGCTGTATCGATGGC 2300
ACTGGTTGGTATGGACCCGCAAGAGTTAACGGCTTTACTTTTTCTTAGAGCCAAAATCGGTAGACCTTTAATAATTGCTAAAATGGCGACATAGCTACCG

Met Thr Asn His Thr Trp Ala Phe Ser Ile Ala Glu Met Lys Lys Asn Leu Gly Phe Ser His Leu Glu Ile Ile Asn Asp Phe Thr Ala Val Ser Met Ala

glk

GAACCCGATGCTGAAAAAAGAGCATCTGATTCAGTTTGGTGGCGCAGAACCGGTCGAAGGTAAGCCTATTGCGGTTTACGGTGCCGGAACGGGGCTTGGG 2400
CTTGGGCTACGACTTTTTTCTCGTAGACTAAGTCAAACCACCGCGTCTTGGCCAGCTTCCATTCGGATAACGCCAAATGCCACGGCCTTGCCCCGAACCC

Asn Pro Met Leu Lys Lys Glu His Leu Ile Gln Phe Gly Gly Ala Glu Pro Val Glu Gly Lys Pro Ile Ala Val Tyr Gly Ala Gly Thr Gly Leu Gly

glk

GTTGCGCATCTGGTCCATGTCGATAAGCGTTGGGTAAGCTTGCCAGGCGAAGGCGGTCACGTTGATTTTGCGCCGAATAGTGAAGAAGAGGCCATTATCC 2500
CAACGCGTAGACCAGGTACAGCTATTCGCAACCCATTCGAACGGTCCGCTTCCGCCAGTGCAACTAAAACGCGGCTTATCACTTCTTCTCCGGTAATAGG

Val Ala His Leu Val His Val Asp Lys Arg Trp Val Ser Leu Pro Gly Glu Gly Gly His Val Asp Phe Ala Pro Asn Ser Glu Glu Glu Ala Ile Ile

glk

TCGAAATATTGCGTGCGGAAATTGGTCATGTTTCGGCGGAGGCGTGCCTTTCTGGCCCTGGGCTGGTGAATTTGTATCGCGCAATTGTGAAAGCTGACAA 2600
AGCTTTATAACGCACGCCTTTAACCAGTACAAAGCCGCCTCCGCACGGAAAGACCGGGACCCGACCACTTAAACATAGCGCGTTAACACTTTCGACTGTT

Leu Glu Ile Leu Arg Ala Glu Ile Gly His Val Ser Ala Glu Ala Cys Leu Ser Gly Pro Gly Leu Val Asn Leu Tyr Arg Ala Ile Val Lys Ala Asp Asn

glk

CCGCCTGCCAGAAAATCTCAAGCCAAAAGATATTACCGAACGCGCGCTGGCTGACAGCTGCACCGATTGCCGCCGCGCATTGTCGCTGTTTTGCGTCATT 2700
GGCGGACGGTCTTTTAGAGTTCGGTTTTCTATAATGGCTTGCGCGCGACCGACTGTCGACGTGGCTAACGGCGGCGCGTAACAGCGACAAAACGCAGTAA

Arg Leu Pro Glu Asn Leu Lys Pro Lys Asp Ile Thr Glu Arg Ala Leu Ala Asp Ser Cys Thr Asp Cys Arg Arg Ala Leu Ser Leu Phe Cys Val Ile

glk

ATGGGCCGTTTTGGCGGCAATCTGGCGCTCAATCTCGGGACATTTGGCGGCGTGTTTATTGCGGGCGGTATCGTGCCGCGCTTCCTTGAGTTCTTCAAAG 2800
TACCCGGCAAAACCGCCGTTAGACCGCGAGTTAGAGCCCTGTAAACCGCCGCACAAATAACGCCCGCCATAGCACGGCGCGAAGGAACTCAAGAAGTTTC

Met Gly Arg Phe Gly Gly Asn Leu Ala Leu Asn Leu Gly Thr Phe Gly Gly Val Phe Ile Ala Gly Gly Ile Val Pro Arg Phe Leu Glu Phe Phe Lys

glk

GCTCCGGTTTCCGTGCCGCATTTGAAGATAAAGGGCGCTTTAAAGAATATGTCCATGATATTCCGGTGTATCTCATCGTCCATGACAATCCGGGCCTTCT 2900
CGAGGCCAAAGGCACGGCGTAAACTTCTATTTCCCGCGAAATTTCTTATACAGGTACTATAAGGCCACATAGAGTAGCAGGTACTGTTAGGCCCGGAAGA

Gly Ser Gly Phe Arg Ala Ala Phe Glu Asp Lys Gly Arg Phe Lys Glu Tyr Val His Asp Ile Pro Val Tyr Leu Ile Val His Asp Asn Pro Gly Leu Leu

glk

FIG. 14D

CGGTTCCGGTGCACATTTACGCCAGACCTTAGGTCACATTCTGTAAATCCTTCCTTTTATATCGGGAGGTAACTCTCCCGATAATCTTTTAAATCATACA 3000
GCCAAGGCCACGTGTAAATGCGGTCTGGAATCCAGTGTAAGACATTTAGGAAGGAAAATATAGCCCTCCATTGAGAGGGCTATTAGAAAATTTAGTATGT

Gly Ser Gly Ala His Leu Arg Gln Thr Leu Gly His Ile Leu •

glk

GTTTATTCAATTTTTCTTTGTGTCCCCTCACAAGGTCGAC 3040
CAAATAAGTTAAAAAGAAACACAGGGGAGTGTTCCAGCTG

FIG. 14E